LINEAR MICROSPORE TETRADS IN THE GRASS STIPA ICHU

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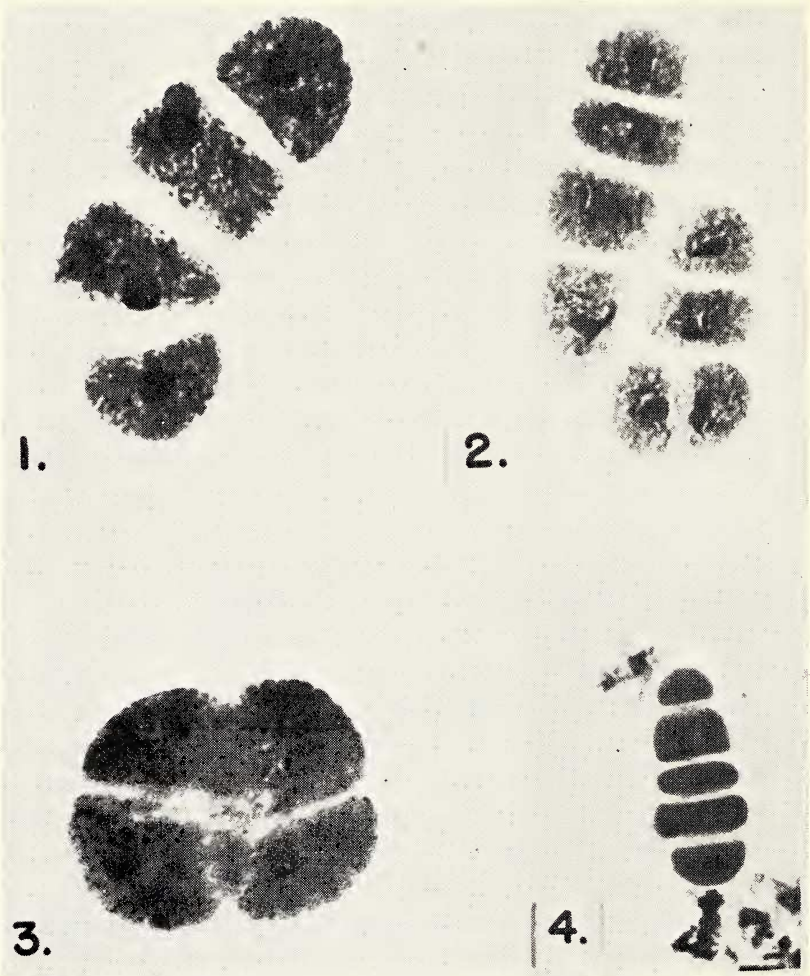
Microspores of angiosperms commonly are in tetrahedal, isobilateral, or decussate tetrads. T-shaped tetrads have been reported for *Aristolochia* (Samuelsson, 1914) and *Butomopsis* (Johri, 1936), and linear tetrads are known to occur in *Halophila* of the Hydrocharitaceae (Kausik and Rao, 1942) *Zostera* of the Zosteraceae (Rosenberg, 1901), and some genera of the Asclepidaceae (Gager, 1902). Two or three types of microspore tetrads have been reported for a number of genera including the monocots *Musa, Agave,* and *Habeneria* (Maheshwari, 1950).

In the Gramineae, division of the microspore mother cells is of the successive type. A cell plate is laid down immediately after the first meiotic division (Maheshwari, 1950). Characteristically and with great regularity the microspore tetrads are isobilateral. Davis (1966) noted that grass microspore tetrads are "occasionally T-shaped or linear" but cited no specific references. It is to be assumed that the extensive literature citation of Davis does include reports of T-shaped and linear grass microspore tetrads but such types certainly are rare.

The purpose of the present paper is to report the occurrence of linear and T-shaped microspore tetrads (figs. 1, 2) in addition to the usual isobilateral tetrads (fig. 3) in *Stipa ichu* (Ruiz & Pav.) Kunth and also the occasional development of linear groups of five microspores (fig. 4) in the same species. Linear and T-shaped microspore tetrads were observed in bud material of *S. ichu* from two widely separated localities in Mexico. One collection *(Gould 11622,* TAES*)* was from 20 miles east of Mexico City and the other *(Gould 11681,* TAES) was from near San Cristóbal de las Casas, near the Guatemalan border. Chromosome numbers were determined to be $2n = 40$ in both collections. Pollen mother cell divisions in the San Cristóbal material, however, were not entirely regular and the count was reported as ca. $2n = 40$ (Gould, 1966). Of possible significance was the collection of *Stipa virescens* H. B. K. at the same locality with a chromosome number of $2n = 60$ and very irregular meiotic divisions.

About 70% of the microspore tetrads of the San Cristóbal *Stipa ichu* plant were linear and the remainder were T-shaped and isobilateral in about equal proportions. A few linear groups of five microspores (fig. 4) were also present. The percentage of linear tetrads in the Mexico City collection was somewhat less than in the San Cristóbal material but linear and T-shaped tetrads were numerous.

Maheshwari (1950) noted that the formation of groups of more than four microspores usually results from lagging chromosomes which organize into micronuclei. He further stated that in general such abnormal-



FIGS. 1–4. Microspores of *Stipa ichu*: 1, linear tetrad; 2 linear tetrad and T-shaped tetrad; 3, isobilateral tetrad; 4, linear group of five microspores. Magnifications not uniform.

ities are found only in hybrids characterized by a high degree of sterility. As can be observed in Fig. 4, the five spores of the *Stipa ichu* "pentad" are fairly uniform in size and all but the apical cell have well-developed, apparently functional nuclei. It is possible that the fifth cell has been organized about a micronucleus, but in that case the terminal position of the extra cell is difficult to explain.

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EXTENSION OF THE RANGE OF ABIES LASIOCARPA INTO CALIFORNIA

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Abies lasiocarpa (Hook.) Nutt. has been located in two drainages near Russian Peak in the Salmon Mountains of Siskiyou Co. During the summer of 1968, while making a vegetational reconnaissance of this area, *A. lasiocarpa* was first located in forests surrounding the meadows west of Little Duck Lake (Etna quadrangle, T. 40N. R. 9W. Sec. 19, elev. 6400 ft). Here it forms a forest with *Tsuga mertensiana* (Bong.) Carr., *Pinus monticola* Dougl., and *Abies magnifica* A. Murr. var. *shastensis* Lemmon. The trees are healthy; reproduction is plentiful with some advancing into the wet meadows.

Later a more extensive forest was found along South Sugar Creek (T. 40N. R. 9W. Sec. 30, 31). In this area the trees not only occur around the wet meadows near South Sugar Lake at 6800 ft, but descend along the creek terraces to 5800 ft. Below 6400 ft *A. lasiocarpa* is mixed with *Picea engelmannii* Parry ex Engelm. Both species are vigorous, and are reproducing well.

It is surprising that this species has not been reported previously. Munz (1959) reports *P. engelmannii* along Sugar Creek, tributary of the Scott River. South Sugar Creek is a branch of this stream. Only a rough and apparently recent trail has been constructed by fishermen to South Sugar Lake, so accessibility is recent. An established Forest Serv-